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THREE NEW PLANETARY NEBULAE

During the past summer I have included in the observing list of the Crossley reflector a number of objects very close to the plane of the Milky Way. The descriptions of the objects in the NGC were of such a character as to raise the suspicion that these might be faint clusters, or even spirals. Most of these nebulae have proved to be of the diffuse type; one or two are faint star clusters. Three nebulae, from the evidence of their form, are undoubtedly planetary nebulae.

NGC I 1295; $18^{h}49^{m}.2$; $-8^{\circ}55'$.

Exceedingly faint; a faint, hazy ring about 2′ x 1′.5, in p. a. 90°±. The central portions are relatively vacant, and it is fainter along and at the ends of the major axis. There are three faint stars at the center, of which one is probably the central star.

NGC 6842; $19^{h}50^{m}.9$; $+29^{\circ}1'$.

Very faint. It is about 50″ x 45″, showing traces of an irregular ring formation. It has a central star of about the 13th magnitude.

NGC 7048; $21^{h}10^{m}.7$; $+45^{\circ}53'$.

A rather faint oval, with slight traces of ring structure. It is about 60″ x 50″ in p. a. 20°±. The brightest portions are at the east end of the minor axis. There is a very faint central star.

The spectrum of NGC 7048 has been examined visually with the 36-inch refractor by Messrs. Campbell and Moore, and found to be gaseous.

HEBER D. CURTIS.

September, 1919.

THE ORBIT OF THE VISUAL BINARY SYSTEM β 1111

One of the practical exercises assigned to my class in the theory of orbits of binary stars at the recent Summer Session of the University of California was the computation of the orbit of β 1111 by the Glasenapp-Kowalsky method. The four members of the class were encouraged to draw many apparent ellipses and to use each his own judgment as to the ellipse best satisfying the observed distances and the law of areas. The result was the four independent sets of elements which follow:

	M. V. Cannon	H. C. Hicks	J. F. Pobanz	H. G. Wrocklage
$P=$	42.18 yrs.	39.26 yrs.	39.67 yrs.	42.07 yrs.
$T=$	1917.87	1919.35	1918.90	1918.20
$e=$	0.248	0.222	0.234	0.245
$a=$	0″.220	0″.412	0″.241	0″.244
$\omega=$	137°.4	165°.7	146°.3	135°.4
$i=$	34.8	34.8	43.0	45.85
$\Omega=$	43.5	37.8	46.0	46.7

Differential corrections to these orbits were undertaken by each student, but the six weeks' session was too short to permit the completion of the work. I have recently carried out such corrections, taking as basis a set of elements derived by interpolation from the four sets given above after a study of the corresponding sets of residuals. When my equations were set up it developed that the coefficients for $\Delta\Omega$ and $\Delta\omega$ were nearly identical. The node was therefore assumed to be known and the solution then carried thru for the remaining elements. The results are as follows:

Elements	Ephemeris		
$P=40.53$ years	1920.38	219°.1	0″.18
$T=1918.38$	1921.38	229 .5	0 .19
$e=0.238$	1922.38	239 .6	0 .19
$a=0''.235$	1923.38	249 .5	0 .19
$\omega=144^\circ.35$	1924.38	259 .5	0 .19
$i=40.8$	1925.38	269 .6	0 .19
$\Omega=43.95$	1926.38	279 .8	0 .19

MEASURES AND RESIDUALS

Date	θ_0	ρ_0			(O–C) $\Delta\theta$	$\Delta\rho$
1889.14	315°.3	0″.19	3n	Burnham	+2°.2	0″.00
1890.43	321 .2	0 .25±	2	Schiaparelli	−3 .7	+0 .05
1892.17	336 .1	0 .21	4	Burnham	−3 .1	−0 .01
1898.52	18 .7	0 .28	7	Burnham and Aitken	+1 .2	+0 .01
1899.30	28 .8	0 .25	1	Lewis	(+7 .6	−0 .03)
1900.20	27 .8	0 .29	3	A.	+2 .3	+0 .01
1901.39	31 .3	0 .28	4	A.	+0 .4	0 .00
1902.34	42 .9	0 .25	1	A.	(+7 .7	−0 .03)
1903.39	38 .3	0 .28	3	A.	−1 .8	0 .00
1905.33	50 .9	0 .25	3	A.	+1 .4	−0 .02
1907.38	60 .5	0 .26	2	A.	0 .0	+0 .01
1910.55	75 .0	0 .17	1	A.	(−8 .4	−0 .03)
1911.49	89 .3	0 .21	2	A.	−3 .2	+0 .03
1912.21	92 .6	0 .18	1	A.	(−8 .2	+0 .01)
1914.46	125 .7	0 .17	3	A.	−2 .0	+0 .02
1916.37	165 .8	0 .17	3	A.	+0 .2	+0 .02
1918.42	189 .2	0 .18	1	A.	(−5 .7	+0 .01)
1919.45	207 .4	0 .16	3	A.	−1 .2	−0 .02

The sum of the squares of the residuals in angle for the separate observations (not the normal places) was reduced only from 393.6 to 343.6; but, if the five residuals enclosed in parentheses are omitted, the reduction is from 122.9 to 56.0. It will be noted that these residuals relate to positions each of which depends upon a single night's measure, and it is obvious from the general run of residuals that they are chiefly due to errors of observation. No essential improvement was made in the representation of the observed distances, the sum of the squares of the residuals being reduced only from .0090 to .0083. ROBERT G. AITKEN.

September 11, 1919.